We claim:

1. A heat exchanger for transferring heat between a first fluid and a second fluid; wherein said heat exchanger comprises first fluid channels through which the first fluid may flow, and second fluid channels through which the second fluid may flow, wherein said second fluid channels lie generally in a plane; wherein said first fluid channels and said second fluid channels interleave, so that heat may be transferred between said first fluid channels and said second fluid channels; wherein the direction of flow of said first fluid channels is generally perpendicular to the plane of said second fluid channels; and wherein said heat exchanger has a density of said first fluid channels greater than about 50 per square centimeter.

2. A heat exchanger as recited in Claim 1, wherein said first fluid channels are adapted for the flow of a gas, and wherein said second fluid channels are adapted for the flow of a liquid.

3. A heat exchanger as recited in Claim 1, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 2.0 mm.

4. A heat exchanger as recited in Claim 1, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 1.0 mm.

5. A heat exchanger as recited in Claim **1**, wherein the width of said second fluid channels, in a direction that is generally perpendicular to the direction of flow of said first fluid channels and is also generally perpendicular to the direction of flow of said second fluid channels, is less than about 500 μm.

6. A heat exchanger as recited in Claim **1**, wherein said heat exchanger has a density of said first fluid channels greater than about 200 per square centimeter.

7. A heat exchanger as recited in Claim **1**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 1.0 mm; wherein the width of said second fluid channels, in a direction that is generally perpendicular to the direction of flow of said first fluid channels and is also generally perpendicular to the direction of flow of said second fluid channels, is less than about 500 μm; and wherein said heat exchanger has a density of said first fluid channels greater than about 200 per square centimeter.

8. A heat exchanger as recited in Claim **1**, wherein said heat exchanger is fabricated from a polymer.

9. A heat exchanger as recited in Claim **1**, wherein said heat exchanger is fabricated from a ceramic.

10. A heat exchanger as recited in Claim **1**, wherein said heat exchanger is fabricated from copper.

11. A heat exchanger as recited in Claim **1**, wherein said heat exchanger is fabricated from aluminum.

12. A heat exchanger as recited in Claim **1**, wherein said heat exchanger is fabricated from metal.

13. A heat exchanger as recited in Claim **1**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 6.0 mm.

14. A heat exchanger as recited in Claim **1**, wherein the width of said second fluid channels, in a direction that is generally perpendicular to the direction of flow of said first fluid channels and is also generally perpendicular to the direction of flow of said second fluid channels, is less than about 2.0 mm.

15. A heat exchanger as recited in Claim **1**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 6.0 mm, and wherein the width of said second fluid channels, in a direction that is generally perpendicular to the direction of flow of said first fluid channels and is also generally perpendicular to the direction of flow of said second fluid channels, is less than about 2.0 mm.

16. A heat exchanger for transferring heat between a first fluid and a second fluid; wherein said heat exchanger comprises first fluid channels through which the first fluid may flow, and one or more second, multiply interconnected fluid channels through which the second fluid may flow; wherein said first fluid channels and said second fluid channels interleave, so that heat may be transferred between said first fluid channels and said second fluid channels; wherein the direction of flow of said first fluid channels is generally perpendicular to the direction of flow of said second fluid channels; wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 6.0 mm; and wherein said heat exchanger has a density of said first fluid channels greater than about 50 per square centimeter.

17. A heat exchanger as recited in Claim **16**, wherein said first fluid channels are adapted for the flow of a gas, and wherein said second fluid channels are adapted for the flow of a liquid.

18. A heat exchanger as recited in Claim **16**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 2.0 mm.

19. A heat exchanger as recited in Claim **16**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 1.0 mm.

20. A heat exchanger as recited in Claim **16**, wherein said heat exchanger has a density of said first fluid channels greater than about 200 per square centimeter.

21. A heat exchanger as recited in Claim **16**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 1.0 mm; and wherein said heat exchanger has a density of said first fluid channels greater than about 200 per square centimeter.

22. A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from a polymer.

23. A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from copper.

24. A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from aluminum.

25. A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from metal.

26. A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from a copper alloy.

27. A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from a nickel-boron alloy.

28. A method for fabricating a cross flow heat exchanger as recited in Claim **16**, said method comprising the steps of:

(a) manufacturing a polymer sheet having a plurality of holes traversing the sheet, wherein the portions of the sheet containing polymer correspond to the one or more second fluid channels, and wherein the holes correspond to the first fluid channels;

(b) plating at least one layer of metal on the surfaces of the polymer sheet, including plating metal on the walls of the holes, but without completely filling the holes with metal; and

(c) removing the polymer without removing the metal;

(d) whereby the metal structure remaining after removal of the polymer is a cross flow heat exchanger as recited in Claim **16**, wherein the spaces in the metal structure where the polymer previously had been become the one or more second fluid channels, and wherein the holes that originally traversed the polymer sheet become the first fluid channels.

29. A method as recited in Claim **28**, additionally comprising the step of manufacturing the polymer sheet by x-ray lithography or by the LIGA process.

30. A method as recited in Claim **28**, wherein said sheet comprises poly(methyl methacrylate).

31. A method as recited in Claim **28**, wherein said removing step comprises dissolving the polymer.

32. A method as recited in Claim **28**, wherein said removing step comprises melting the polymer.

33. A method as recited in Claim **28**, wherein said plating step comprises electrode-less plating of a metal layer.

34. A method as recited in Claim **33**, wherein said electrode-less plating step comprises first, sputtering onto the polymer sheet a first metal layer having a thickness about 1 μm thick or less, and second, catalytically depositing onto the first metal layer a second metal layer having a thickness between about 25 μm and about 150 μm.